

MODEL AND A SIX SIGMA MODEL TO ASSESS PERFORMANCE IN A MILITARY ENVIRONMENT

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Military officials continually search for improvements in processes that focus on high-performance outcomes. This qualitative study investigated process improvements of two departments within the Naval Diving and Salvage Training Center (the Security Department and the Testing Department) by assessing performance levels of the two departments using a combinatorial model from human performance theory and Six Sigma theory. Study findings produced strong empirical evidence with specific recommendations for initiating cost-effective interventions for improvements. The Behavior Engineering Model was used to identify possible solutions to post-training performance gaps identified during the evaluation.

THE NEED FOR MILITARY environments to provide efficient and effective operations propels researchers and military officials to continually search for improvements in processes that focus on high-performance outcomes. This study investigated process improvements of two departments within the Naval Diving and Salvage Training Center (the Security Department and the Testing Department) by assessing performance levels of the two departments using a combinatorial model from human performance theory and Six Sigma theory. This article comprises six sections that represent the focus areas of the study: (a) a brief summary of the background information and rationale that prompted the current study; (b) an overview of the Human Performance Technology Model and the Six Sigma Theory Model relative to the combinatorial model developed for this study; (c) a statement of the purpose and study objectives; (d) the methodology and procedures for conducting the study; (e) data analysis, results, and recommendations; and (f) conclusions of the investigation.

Command Public Affairs, 2003) mandated alignment and reduction of existing manpower resources with job functions. The commanding officer of the Naval Diving and Salvage Training Center in compliance with these resources reduction requirements implemented a plan that included downsizing specific positions. The new mandates did not provide for a Security Department position and only one position for the Testing Department, even though both of these departments are responsible for full-time operational activities. For example, the Security Department is responsible for all staff and student security clearances and the Testing Department is responsible for continual monitoring and information processing for students and staff. The commanding officer's reduction plan established one individual (enlisted staff) in a dual role as the assistant security manager and the testing officer. Impending budget cuts and additional threats of billet reductions prompted the commanding officer to request assistance for examining these changes in personnel and the study emerged from a grassroots level, whereby the study investigated using a sound theoretical model focused on process improvement.

TABLE 1 HUMAN PERFORMANCE THEORY, SIX SIGMA THEORY, AND COMBINATORIAL MODEL		
HUMAN PERFORMANCE THEORY (ISPI, 2010; RUMMLER, 1999; STOLOVITCH & KEEPS, 1999; VAN TIEM, MOSELEY, & DESSINGER, 2001)	SIX SIGMA THEORY (ADAMS, GUPTA, & WILSON, 2003; ANTHONY, 2008)	COMBINATORIAL MODEL
Inputs	Define the problem	Use input to define the problem
Outputs	Measure key aspects of the current processes	Measure key aspects of the current processes by examining current outputs
Consequences of performance	Analyze the data and determine defects and relationships	Use data from performance to determine the defects and relationships as consequences of current performance
Feedback	Improve the current process with standards	Provide feedback to improve the current process with standards
Skill and knowledge employed by the performers	Control future state processes	Control future state processes by determining the skill and knowledge employed by the performers

The Human Performance Technology Model (International Society for Performance Improvement [ISPI], 2010; Stolovich & Keeps, 1999) emphasizes process improvement encompassing inputs, outputs, performance, feedback, and performers' skills and knowledge. The Six Sigma Theory Model (Anthony, 2008, p. 3) requires "the implementation of a measurement based strategy that focuses on process improvement and variation reduction." Within the Six Sigma model, the DMAIC methodology (defined below) is a system that brings measurable and significant improvement to existing processes (Anthony & Banuelas, 2002). The DMAIC is an acronym for five interconnected phases as follows:

1. Define the project goals and deliverables for both internal and external customers.
2. Measure the process to determine current performance.
3. Analyze and determine the root cause(s) of the defects.
4. Improve the process by eliminating defects.
5. Control future process performance.

Both models emphasize the importance of data-driven, decision-making, and determination of root causes. Specific components of the Human Performance Technology Model and the Six Sigma (DMAIC) Model (Adams, Gupta, & Wilson, 2003) were examined relative to common constructs to develop a sound framework for the investigation. The resulting combinatorial model

The project included assessing the effectiveness and efficiency of the operational processes associated with the Security and Testing Departments utilizing an innovative assessment model for the purpose of improving processes that focus on high-performance outcomes. Specific project objectives are as follows: (a) describe existing business practices within the two departments, (b) identify current policies and procedures in the Security and Testing Departments, (c) determine the person hours required to perform the responsibilities within the Security and Testing Departments, and (d) final review of processes.

METHODOLOGY AND PROCEDURES

The study methodology consists of a qualitative investigation of existing processes within the Security and Testing Departments using the foundational assessment components inherent in the combined frameworks of Human Performance Theory (Rummler, 1999; Van Tiem, Moseley, & Dessinger, 2001) and Six Sigma Theory. Specific procedures that were employed in the investigation include identifying characteristics of the participants (performer groups), assessing processes of these individuals relative to their declared responsibilities, and determining the impact of the performer groups on the processes that are critical for effective and efficient departmental operations.

PURPOSE STATEMENT AND PROJECT OBJECTIVES

served as the foundation for the current study. Each of the models is highlighted in Table 1 with specific constructs identified and described.

OVERVIEW OF THE HUMAN TECHNOLOGY PERFORMANCE MODEL AND THE SIX SIGMA MODEL

The need for military environments to provide efficient and effective operations propels researchers and military officials to continually search for improvements in processes that focus on high-performance outcomes.

The study methodology and procedures are delineated in two sections: Performer Group Assessment Procedures and Procedures and Resulting Assessment Information.

Performer Group Assessment Procedures and Resulting Information

Performer groups included in the qualitative investigation comprise those personnel directly related to the Security and Testing Departments. Tables 2 and 3 include identification of the performers, listing of the assessment procedures, and the resulting assessment information. A process flow chart of the Testing Department processes was created to aid the researcher to understand the departmental processes. The flow chart is depicted in Appendix A.

Procedures and Resulting Assessment Information

Two assumptions spearheaded the investigation: (a) Performance of the Naval Diving and Salvage Training Center Testing and Security duties and responsibilities each consume one person year, and (b) specific metrics were established to calculate the total number of person hours required to complete the testing and security processes. Interviews were conducted to determine the existing inputs and outputs of the performer groups. Four individuals were interviewed to obtain the assessment information for the investigation: the Naval Diving and Salvage Training Center testing officer, Security Department manager, assistant Security Department manager, and information assurance manager. Resulting assessment information retrieved from the interview data are reflected in Tables 1 and 2 relative to the Naval

DATA ANALYSIS, RESULTS, AND RECOMMENDATIONS

Diving and Salvage Training Center Security and Testing Departments' responsibilities using the combinatorial model. Governing management documents were reviewed to assess the alignment of the Naval Diving and Salvage Training Center processes with applicable Joint Personnel Adjudication System, Secretary of the Navy, the Department of the Navy, and the Naval Education and Training security and testing mandates. Appendix C lists the references reviewed for the study. Three documents were reviewed for assessing testing alignments of man-dates and seven documents were reviewed for assessing alignments of designated security mandates (see references in Appendix C). Resulting assessment information from the document reviews are indicated in Tables 2 and 3 relative to the Naval Diving and Salvage Training Center Security and Testing Departments' responsibilities using the combinatorial model.

Data analyses, results, and recommendations are presented relative to specific areas of consideration that emerged from the assessment procedures delineated in Tables 2 and 3. Areas of discussion are as follows: (a) personnel hours, (b) security of materials, (c) responsibilities and duties, and (d) additional responsibilities and duties of the Security and Testing Departments.

Data Analyses and Results

Establishing metrics to measure the personnel hours associated with the security and testing procedures was accomplished by developing metrics that consisted of measuring the estimated processing or duty time in minutes for each identified task, the number of times the task was performed each year in person hours, and the final or total processing time in person hours. The researcher discovered the estimated person hours for the security and testing processes and duties found nearly two person years (1.8 person years) were required to complete these two functions (see Table B1 in Appendix B). Results of the document review assessment information and the interview assessment information indicated that classified materials were not stored at the Naval Diving and Salvage Training Center because of security storage requirements at the Center, reflecting only non-classified materials. The processes and duties of the Security Department manager and assistant Security Department manager are delineated in Table B2 (see Appendix B). The data alignment from the assessment information retrieved

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SECURITY DEPARTMENT ASSESSMENT INFORMATION			
COMBINATORIAL MODEL	PERFORMERS	RESPONSIBILITIES	INPUT
<p>Use data from performance to determine the impact, problems, and relationships as consequences of current performance</p> <p>Measure key aspects of the current processes by examining current outputs</p>	Commanding officer	Establish an effective security program and designate a security manager	Comply with and implement the Department of Defense Information and Personnel Security Program
	Security manager	Execute policy for security processes	Ensure training and resources are available
	Assistant security manager	Support the security manager; manage the personnel security program and internal security processes	Complete security forms, ancillary documents, and joint personnel adjudication system input
	Instructors	Communicate security administrative requirements to students	Schedule student availability
COMBINATORIAL MODEL	PERFORMERS	RESPONSIBILITIES	OUTPUT
<p>Use data from performance to determine the impact, problems, and relationships as consequences of current performance</p> <p>Establishment of metrics for calculating security processes</p>	Commanding officer	Establish an effective security program and designate a security manager	Organizational vision and guidance regarding security requirements
	Security manager	Execute policy for security processes	Feedback regarding security effectiveness provided to commanding officer
	Assistant security manager	Support the security manager; manage the personnel security program and internal security processes	Documentation of standardized personnel security program and internal security processes in effect
	Instructors	Communicate security administrative requirements to students	Documentation of student awareness levels and meetings with assistant security manager
COMBINATORIAL MODEL	PERFORMANCE FOCUS	DESCRIPTION AND DATA SOURCES	DATA RETRIEVED
<p>Use data from performance to determine the impact, problems, and relationships as consequences of current performance</p> <p>Establishment of metrics for calculating security processes</p>	Assumptions	Performance of security duties and responsibilities consists of one year of data	Total security person hours = 2,130 or 57% of total person hours reflected in Table B1 located in Appendix B
	Interviews	Naval Diving and Salvage Training Center security manager, assistant security manager, and information assurance manager	See Tables B3 and B4 in Appendix B
	Documents	Secretary of the Navy M-5510.30 and M-5510.36 MILPERSMAN 1306.618 MILPERSMAN 1220-120 MILPERSMAN 5510-010 NDSTICINST 5510.1	See References section and Tables B1 and B2 in Appendix B

TABLE 2 SECURITY DEPARTMENT ASSESSMENT INFORMATION (CONTINUED)

COMBINATORIAL MODEL		PERFORMANCE	ANALYSIS FROM DATA SOURCES	DATA SUMMARY
Provide feedback to improve the current process with standards	Processes and duties of security manager	The security manager performed 15 out of the 17 duties and responsibilities listed in Table B2 (Appendix B) that pertain to the role	Performance rate is 88% for the security manager	
Processes and duties of the assistant security manager	The assistant security manager performed 5 out of the 24 duties and responsibilities listed in Table B2 (Appendix B) that pertain to the role	Performance rate is 21% for the assistant security manager		
Required responsibilities of the current security department	The security department did not perform two required processes and duties during the assessed performance year or 7% of the required duties	No evidence of performance of two duties (see Table B2 highlighted items in Appendix B)		
Processes and duties involving person hours of the security department	No person hours recorded for four duties involving staff and tracking security forms (see Table B1 in Appendix B)	Zero values recorded for four areas of estimated person hours (see Table B1 highlighted items in Appendix B)		
Additional military responsibilities and duties for security	Eighteen additional duties and processes are listed in Table B4 (see Appendix B) for the security department including after normal working hours duties	A total of 470 person hours of additional duties and responsibilities are reported in Table B4 (see Appendix B)		
Facilities and equipment related to performance	Interview qualitative data from the assistant security officer produced three areas of information	Information gathered includes (a) no standalone copier for classified information, (b) no classified office and telephone for security purposes, and (c) no security education program in place		
FUTURE CONSIDERATIONS		RECOMMENDATIONS	DECISIONS	
Control future state processes by determining the skill and knowledge employed by the performers	Examination of data summary information	Seven recommendations specific to the Security Department with additional recommendations for executive management are presented in the conclusions and recommendations section	Generate the most effective and efficient recommendations	

Note. The table information was developed with the assistance of Lieutenant Commander Swiergosz and Haywood West.

from interviews and document reviews indicated that the responsibilities of the Security Department manager and assistant Security Department manager were not aligned in accordance with applicable directives. There are two processes and duties, highlighted in Table B2 (see Appendix B), indicate processes and duties that were not being performed by the Security Department. In addition, the data analysis of the assessment information, highlighted in the rows in Table B1 (see Appendix B), which indicate problem areas and misalignment. In addition, the data analysis of the assessment information, highlighted in the rows in Table B1 (see Appendix B), indicate processes and duties that were not being performed by the Security Department.

TABLE 3 TESTING DEPARTMENT ASSESSMENT INFORMATION

COMBINATORIAL MODEL	PERFORMERS	RESPONSIBILITIES	INPUT
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Use input to define the problem

Commanding officer	Establish policy for testing program	Develop policy for maintaining testing requirements
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Executive officer	Execute policy for security processes	Ensure performer training and resources are available
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Training officer and instructors	Determine student status and the scope of the test material	Generate student rosters and modified test questions
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Testing officer and instructors	Manage testing process	Generate written course evaluations and review student rosters
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Student controller	Manage local and corporate student data	Review local area network student database
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Instructors	Administrate testing processes	Schedule and monitor tests
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Students	Prepare for course evaluations	Complete course tests and course critiques
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COMBINATORIAL MODEL

Measure key aspects of the current processes by examining current outputs

Commanding officer	Establish policy for testing program	Organization vision and guidance regarding testing requirements
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Executive officer	Execute policy for security processes	Feedback provided to commanding officer regarding testing policy effectiveness
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Training officer and instructors	Determine student status and the scope of the test material	Valid student rosters and updated testing material
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Testing officer	Manage testing process	Test administration
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Student controller	Manage local and corporate student data	Local student rosters
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Instructors	Administrate testing processes	Test scores available for testing officer to review
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Students	Prepare for course evaluations	Testing data ready for analysis
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COMBINATORIAL MODEL

Use data from performance to determine the impact, problems, and relationships as consequences of current performance

Assumptions	Performance of testing duties and responsibilities consists of one year of data Establishment of metrics for calculating testing processes	Total testing person hours = 1,633 or 43% of total person hours reflected in Table B1 located in Appendix B
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Interviews	Naval Diving and Salvage Training Center testing officer and information assurance manager	See Tables B1 and B2 in Appendix B
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Documents	Naval Education and Training 130 and 135 manuals and NDCSTCINST 1540.10 Testing Instruction	See References section and Tables B1 and B2 in Appendix B
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TABLE 3

TESTING DEPARTMENT ASSESSMENT INFORMATION (CONTINUED)

COMBINATORIAL MODEL	PERFORMANCE FOCUS	ANALYSIS FROM DATA SOURCES	DATA SUMMARY
Provide feedback to improve the current process with standards	Processes and duties of testing officer	The testing officer did not perform data access and data mining duties and responsibilities as indicated by no person hours recorded for that duty (see Table B1)	Zero values recorded for four areas of estimated person hours (see Table B1 highlighted items)
	Required responsibilities of the current testing department	The testing officer did not perform six of the required processes and duties during the assessed performance year or 50% of the required duties	No evidence of performance of six required duties (see Table B3 highlighted items in Appendix B)
	Additional military responsibilities and duties for security	Eighteen additional duties and processes are listed in Table B4 (see Appendix B) for the testing department including after working hours duties	A total of 470 person hours of additional duties and responsibilities are reported in Table B4
COMBINATORIAL MODEL	FUTURE CONSIDERATIONS	RECOMMENDATIONS	DECISIONS
Control future state processes by determining the skill and knowledge employed by the performers	Examination of data summary information	Three recommendations specific to the testing department with additional recommendations for executive management are presented in the conclusions and recommendations section	Generate the most effective and efficient recommendations

Note. The table information was developed with the assistance of Lieutenant Commander Swiergosz and Haywood West.

In addition, resources for the Security Department were described as limited. For example, the department does not have a stand-alone copier for processing classified and "For Official Use Only" information, there is no classified office space with a secure telephone to support sensitive communications with other organizations, and there is no security education program in place. These findings suggest that there was not enough time or resources to complete the security management responsibilities in accordance with standard directives.

The typical duties of the testing officer are listed in Table B3 (see Appendix B). The analysis of data from the assessment of documents and interview information produced findings that suggest that six duties were not performed, as indicated by the highlighted processes and duties in Table B3. The information retrieved relative to the testing department is as follows: (a) frequent interruptions interfere with the completion of the testing officer's duties and (b) insufficient scheduling with little or no automation processes creates duplication of efforts. These findings suggest that there was not enough time or

resources to complete the testing management responsibilities in accordance with standard directives. Additional data analyses were performed from interviews and document reviews for the Security and Testing Departments. Other assigned responsibilities required for Security and Testing Department officers were assessed. There are additional military responsibilities that the Security Department and testing officers must perform as a U.S. Navy Master Chief and a Master Explosive Ordnance Disposal Technician, respectively. These responsibilities are reflected in Table B4 (see Appendix B).

Recommendations

Based on the findings from the data analyses of assessment information provided through the combinatorial model of the Human Performance Theory and the Six Sigma Theory, recommendations for initiating cost-effective interventions are as follows:

- The Security Department must align security procedures with applicable Department of the Navy

provided a baseline to demonstrate the organizations and subsequently the study's information was used by the commanding officer, to obtain fully funded positions for the testing officer and assistant Security Department manager. The organization manpower adjustments were completed in the fall of 2007. The methodology developed for the study—to assess a military environment—provided a strong model for future studies to examine organizational methods by incorporating human performance technology and Six Sigma into a combinatorial model and multiple data sources in an effective interchange of empirically sound results. ***

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- and Secretary of the Navy requirements (SECNAV M-5510.37); define the roles and responsibilities of the assistant Security Department manager and Security Department manager in accordance with the new security manuals (SECNAV M-5510.36 and SECNAV M-5510.30); update the current Naval Diving and Salvage Training Center Instruction manual (NAVDIVSALVTRACENINST 5510.1); establish technical capability for secure communications with other organizations; establish a security education program; and obtain a stand-alone copier for processing classified or sensitive information.
- The testing officer must align testing procedures with applicable Naval Education and Training references (i.e., Naval Education and Training 135B Section 3.5 Testing Officer Typical Duties), complete in-service requirements, and update the current Naval Diving and Salvage Training Center Instruction manual (NAVDIVSALVTRACENINST 1540.10).
 - The Security Department manager and testing officer must map and establish flowcharts for testing and security processes.
 - The executive management must consider purchasing appropriate software licenses to support the creation of organizational and procedural charts and establish technology resources to support efficient scheduling efforts.
 - The Center for Explosive Ordnance Disposal and Diving Executive Director and Administration must investigate the establishment of a civilian assistant Security Department manager position and a civilian testing officer position.

CONCLUSIONS

During the initial project analysis, collaboration with Naval Diving and Salvage Training Center staff inspired the idea to use the human performance technology and the Six Sigma (DMAIC) models to create a combinatorial model. The amalgamation resulted in a viable model capable of assessing the complex military environment. The combinatorial model's systematic process was employed to identify and reduce bottlenecks and improve the organization effectiveness. The Testing and Security Departments were found to be inadequate in regard to manpower, dual positional responsibilities, and time management. I (the first author, W. A.) made numerous recommendations to the commanding officer, which may lead to the enhancement and improvement of the organization. The study results